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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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09/981,852

10/17/2001

David Merricks

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05/04/2004

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EXAMINER

NGUYEN, HA T

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 05/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/981,852

Applicant(s)

MERRICKS ET AL.

Examiner

Ha T. Nguyen

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 March 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 8-11, 13 and 18-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 8-11, 13 and 18-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed 12-18-3 has been entered and made of record.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103[©] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-5, 8-11, and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (USPN 6197181) in view of Mahapatra et al. (USPN 6301399, hereinafter "Mahapatra").

Referring to Figs. 2A-2E, 5 and related text, Chen discloses [Claims 1-5, 8-11, 18, 20] a method of manufacturing an electronic device (inherently an article produced) having a metal seed layer, substantially free of discontinuities disposed on a substrate comprising the step of contacting a metal seed layer having discontinuities disposed on a substrate having one or more apertures having a size of $\leq 1\mu\text{m}$ with an alkaline copper electroplating bath, the contacting step both provide the metal seed layer substantially free of discontinuities and substantially fill the apertures with copper; wherein the electroplating bath has a pH of from 8 to 9; wherein the

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electroplating bath further comprises a complexing agent; wherein the electroplating bath further comprises one or more bases selected from ammonium hydroxide of tetra(C1-C4) alkylammonium hydroxide; wherein the electroplating bath further comprises one or more compounds selected from halides, brighteners, suppressor, levelers, grain refiners, wetting agents or surfactants (or one or more brightener compounds in an amount of ≥ 1.5 mg/l) (see col. 5, line 21-col. 6, line 5). But it does not disclose expressly the Cu bath comprising copper pyrophosphate. However, the missing limitation is well known in the art because Mahapatra discloses this feature (see col. 6, lines 20-30). A person of ordinary skill is motivated to modify Chen with Mahapatra to obtain plated copper film of low resistivity.

[Claim 19] Chen also discloses that the substrate is an integrated circuit device (see col. 1, lines 16-40 and Summary).

Therefore, it would have been obvious to combine Chen with Mahapatra to obtain the invention as specified in claims 1-5, 8-11, and 18-20.

4. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Mahapatra, as applied above, and further in view of Tsai et al. (USPN 6110817, hereinafter "Tsai").

The combined teaching of Chen and Mahapatra discloses substantially the limitations of claim 13, as shown above. Chen also discloses a planarizing step (see col. 7, lines 20-25).

But it does not disclose expressly contacting the substrate with a rotating polishing pad.

However, the missing limitation is well known in the art because Tsai discloses the use of CMP for planarizing Cu (col. 4, lines 43-46), CMP involving contacting the semiconductor wafer with a rotating polishing pad thereby removing the excess material from the semiconductor wafer.

A person of ordinary skill is motivated to modify Chen and Mahapatra with Tsai to obtain a global planarization ensuring better integration density of the device made.

Therefore, it would have been obvious to combine Chen and Mahapatra with Tsai to obtain the invention as specified in claim 13.

Response to Amendment

5. In view of the Applicants' cancellation of the claims, the rejection of claims 6-7,12, 14-17 under 35 U.S.C. 103 is rendered moot.

Applicants' arguments with regard to the rejections under 35 U.S.C. 103 of the remaining claims have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argued that Chen does not teach the claimed invention because it does teach a single bath to both enhance a seed layer and substantially fill the apertures, in Chen the seed layer enhancing step is followed by an other electroplating step to fill the apertures. The examiner disagreed. Chen's seed enhancing step also simultaneously fills the apertures substantially. Chen still reads on the claims because no thickness is claimed therefore the claims do not preclude this interpretation. Besides, the use of "comprising" allows additional steps to be performed.

Mahapatra is used to show that like a Cu sulfate bath a Cu pyrophosphate is commonly used in the art to deposit Cu. Note that applicant's arguments are largely directed to what the cited references teach individually. However, it is axiomatic that one cannot show nonobviousness by attacking references individually where the rejection, as here, is based on a combination of references. *In re Young*, 403 F.2d 754, 159 USPQ 725 (CCPA 1968); *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). For example, applicant argues that Mahapatra does not disclose a discontinuous seed layer as here claimed. However, Chen, not Mahapatra, is employed in the rejection to show that feature of the claimed process.

Similar arguments apply in response to applicants' arguments concerning Tsai.

Therefore Chen in combination with the applied references does make obvious all the claimed limitations.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (571) 272-1678. The

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examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (571) 272-1679. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen

Primary Examiner

04- 30- 04